

TMDLs and the Interpretation of the General Standard Criteria

For: Virginia Ad Hoc TMDL Committee

By: Peter Gold, EPA Region III

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VADEQ, Piedmont Regional Offices

TMDLs and the Interpretation of the General Standard Criteria

- Talk Outline

- Statutory Authority
- Regulatory Authority
- Designated Uses
- Water Quality Criteria
- Use of Bioassessments
- Listing Guidance and Impairment Decisions
- Benthic TMDLs

Statutory Authority 1972

- Section 303 of the Clean Water Act (CWA)
 - Requires the Establishment of Water Quality Standards (WQS)
 - Requires the Listing and Development of TMDLs on Impaired Waters
- Section 304 CWA
 - Water Quality Criteria Reflecting Latest in Scientific Knowledge
- Section 305 CWA
 - Assessment of State's Water Quality

Statutory Authority 1987

- Section 304(a)(8) Directs EPA to Develop Information on Methods for Measuring WQC ... Includes Biological Monitoring to Evaluate:
 - Effects of Pollutants on Community and Attributes
 - Factors to Restore and Maintain Integrity

Regulatory Authority

- Components of WQS
 - Designated Uses (40 CFR 131.10)*
 - Criteria to Protect Uses (40 CFR 131.11)*
- * Either Can be Basis for Impairment
- Antidegradation Policy (40 CFR 131.12)
- Implementation Policies (40 CFR 131.13)
 - At States' Discretion not Required

Regulatory Authority

- **Designated Uses**

- **Must Identify Uses to be Achieved and Protected**

- **Protection and Propagation of Fish ... Wildlife ****
 - **Recreation in and on the Water ****
 - **Public Water Supply**
 - **Industry**
 - **Navigation**
 - **Others**

**Statutory Requirements

State Designated Uses

- Virginia's Designated Uses
- (9 VAC 25-260-10): *"All state waters ... are designated for the following uses: ...the propagation and growth of a balanced, indigenous population of aquatic life...which might reasonably be expected to inhabit them;..."*
- Additional aquatic life uses for stockable trout, natural trout and shellfish
- Includes Bay aquatic life uses
- Other uses include recreation and public water supply

State Designated Uses

- Pennsylvania
 - Several Aquatic Life Uses: Warm Water, Cold Water and Migratory Fishes and Trout Stocking
 - *WWF Warm Water Fishes*—Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

State Designated Uses

- Maryland
 - Several Aquatic Life Uses including Nontidal Warm Water and Cold Water and Bay Uses
 - USE I: Water Contact Recreation, and Protection of Nontidal Warmwater Aquatic Life
 - **Use I-P:** Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply
 - **Use II:** Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting ...

State Designated Uses

- Delaware
 - Does not use a Narrative to Explain the Use
 - It is Defined in Definitions as “All Animals and Plant Life Found in Delaware, Either Indigenous or Migratory...”
 - All of Waters are Identified as Having a Fish, Aquatic Life and Wildlife Use
 - Narrative Definition in Criteria

State Designated Uses

- Connecticut
 - Waters Identified as being One of Five Categories: AA, A, B, C and D
 - Fish and Wildlife Use Called for in Waters AA, A and B
 - Class C and D: Current WQ Precludes Attainment of all Uses, Suitable for Certain Fish and Wildlife

State Designated Uses

- Tennessee
 - “Waters have many uses which in the public interest are reasonable and necessary. Such uses include propagation and maintenance of fish and other aquatic life.....”

Regulatory Authority

- Water Quality Criteria (40 CFR 131.11)
 - To Protect & Support Designated Uses
 - Form of Criteria
 - Numeric or Narrative
 - Aquatic Life Criteria
 - » Nutrient Criteria
 - Human Health Criteria
 - Biological Criteria

Water Quality Criteria

- Biological Criteria
 - Expressed as Narrative or Numeric Criteria
 - Describe the Desired Biological Condition
 - Developed Based on an Appropriate Reference Condition
 - Example Narrative
 - “Waters Shall be Free From Substances in Concentrations or Combinations that would Adversely Alter the Structure and Function of Aquatic Communities, as Defined by Reference.”

Water Quality Criteria

- Virginia's Narrative Criteria
- (9 VAC 25-260-20): *"All state waters shall be free from substances ... which are harmful to human, animal, plant, or aquatic life."*

Water Quality Criteria

- Maryland's Numeric Criteria
- Quantitative assessments of biological communities in streams (biological criteria) may be used ... to assess whether water quality....
- The results of the quantitative assessments of biological communities shall be used for purposes of water quality assessment, ...§§303(d) ...
- These assessments shall use documented methods that have been subject to technical review ...consistent and repeatable results....
- ... Department shall allow for the uncertainty and natural variability in environmental monitoring results by using established quantitative and statistical methodologies ...
- The Department shall determine whether the application and interpretation of the assessment method are appropriate....

Water Quality Criteria

- Pennsylvania's Criteria
 - Narrative 25 PA 93.6
 - Water may not contain substances attributable to point or nonpoint source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life.
 - Bioassessment Criteria for Exceptional Waters
 - Numeric Criteria for Toxics

Water Quality Criteria

- Delaware
- Narrative
 - 4.1.1.3 Any Pollutants ... That may interfere with attainment and maintenance of designated uses of that water
- Numeric
 - Acute and Chronic Toxics

Water Quality Criteria

- Tennessee 1200-4-3-0.3(k)
 - “... Waters shall not be modified through the addition of pollutants ... or physical alteration to the extent that diversity and/or productivity of aquatic biota are substantially decreased or adversely affected”
 - Exceptions
 - Continues “Condition ... will be measured by use of metrics ... RBP... or Other Scientifically Defensible Method...”
 - Separate Narrative Criteria for Solids, Turbidity and Odor
 - Numeric Criteria for DO and Other Pollutants

Water Quality Criteria

- Connecticut
 - “Benthic Macroinvertebrate criteria may be utilized where appropriate for assessment of biological integrity of surface waters...”
 - Class Specific
 - Class AA: “A wide variety of macroinvertebrate taxa should ... be present and all functional feeding groups ... well represented ... Taxa within the orders stoneflies, mayflies, ... and caddisflies should be well represented.”

Bioassessments and Criteria

- Bioassessments Conducted to Determine Support of Aquatic Life Use (ALU):
 - Maybe Based on Narrative Biocriteria
 - Criteria must use Appropriate Reference Conditions to Demonstrate Desired Biological Condition

Bioassessments and Criteria

- EPA Guidance
 - Since 1994 Bioassessments Used for Determining ALU Impairment and Listing
 - 2004 Guidance “States Should Include ... Waters in Category 5 ... in Relation to Bioassessments used to Evaluate ALU ...”
 - 2006 Guidance Consistent with Past Guidance

Bioassessment and Criteria

- Summary of Bioassessment Programs (2002)
 - 49 States had Benthic Assessment in Place
 - 37 States Used Bioassessment for Aquatic Life Use
 - 26 States had Biocriteria in WQS
 - 3 Numeric Biocriteria in WQS

Bioassessments and Criteria

- Conducted to Determine Attainment of Aquatic Life Use and Criteria
- Bioassessment Finds:
 - Water is Impaired, Failing to Support DU
 - Water Unimpaired, Supporting DU
- Failing Water Listed as Needing TMDL
- No Specific Pollutant Identified
 - Identified as Benthic Impairment

Bioassessments and Criteria

- Region III Bioassessment Listings
 - Virginia
 - 150 Freshwater Benthic Impairments
 - 10 Estuarine Benthic Impairments
 - Delaware
 - 115 Waters Listed for Biocriteria
 - Pennsylvania
 - 97% of State Waters Assessed via Bioassessment
 - Maryland

TMDLs for Aquatic Life Use Impairment

- Water Identified as Impaired, No Source of Impairment
- TMDL Developed to Attain Criteria through Control of Pollutants
- Pollutant must be Identified to Develop TMDL
 - Stressor Identification

TMDLs for Aquatic Life Use Impairment

- Stressor Identification
 - Bioassessments Revisited
 - Based on Community Composition can Pollutant or Pollutant Type be Determined?
 - Habitat Assessments Revisited
 - Sedimentation Problems?
 - Often a New Bioassessment Conducted

TMDLs for Aquatic Life Use Impairment

- Stressor Identification
 - Evaluate Conventional (pH, DO, Temp) and Toxics (Metals, Pesticides) Data
 - Additional Data Collection
 - Toxicity Tests
 - Diurnal DO Monitoring
 - Additional Monitoring for Nutrients/TSS
 - Conventional Pollutants
 - Identify all Stressors

TMDLs for Aquatic Life Use Impairment

- Once Pollutant(s) Found
 - TMDL Developed for Each Pollutant
 - TMDL Must be Developed to:
 - Meet Criteria (Fully Supporting Bioassessment)
 - Quantify Loadings and Split into LA and WLA
 - Account for Critical Conditions and Seasonality
 - Include a MOS
 - Have Reasonable Potential
 - Subject to Public Participation

TMDLs for Aquatic Life Use Impairment

- TMDLs Developed Using:
 - Reference Watershed Approach
 - Appropriate Loadings Determined based on Conditions in Non-Impaired Watershed with Similar Characteristics
 - Carlsons Trophic Status Index
 - A Total Phosphorous (TP) or Chl A Loading Based on Borderline Eutrophic Carlson TSI Score
 - Statistical Approach

Benthic TMDL Development UT Chickahominy

- Impairment: UT Chickahominy Does not Support a Healthy Benthic Macroinvertebrate Community.
 - Determination of Impairment Based on RBP II.
 - Based Upon Upstream Reference Station
 - Listing Does not Identify Stressor (Pollutant) or Endpoint
 - Location: UT Chickahominy in James River Basin
 - Eastern Virginia
 - 1.50 Mile Impaired Segment
 - Forests Account for 65 Percent of Watershed
- * Chickahominy watershed effluent standard for total phosphorus: 0.1 mg/L, Exemption for UT Chickahominy

Benthic TMDL Development UT Chickahominy

- Candidate Causes:

- Sedimentation
- Degraded water quality (e.g., low DO, nutrients, ammonia, etc.)
- Toxic pollutants
- Habitat impacts (riparian zone)



- Identified stressors need to be reduced to allow for improvement in the benthic community

- Data Analyses

- Ambient Water Quality Data: Temperature, DO, BOD, sedimentation (TSS), nutrients, etc.
- DEQ storm sampling data
- RBP habitat data
- 24-hour dissolved oxygen data
- GMU water quality and biomonitoring data
- EPA toxicity tests: Measured survival/growth/reproduction of test organisms

Benthic TMDL Development UT Chickahominy

- P endpoint based on a eutrophication study of southeastern lakes and reservoirs (Reckhow 1988).
- Eutrophication model for the “farm pond” based on the calculations in Reckhow 1988.
 - Chlorophyll *a* concentration of 20 µg/L was chosen to represent the onset of eutrophication.
- Phosphorus reductions were based on the phosphorus load (for the pond) that meets this Chlorophyll *a* target.
- Model predictions:
 - Existing phosphorus load: 1,332 lbs/year
 - Target (TMDL) load: 434 lbs/year (67 % reduction)
- Phosphorus load estimates:
 - Watershed Model
 - Waterfowl contributions
 - Point source load calculated

Benthic TMDL Development UT Chickahominy

- (GWLF (Generalized Watershed Loading Functions) model was used to estimate phosphorus loads contributed by land uses in the watershed.
- Model attributes
 - Continuous simulation model
 - Models surface runoff using the Soil Conservation Service curve numbers
 - Based on the Universal Soil Loss Equation

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Questions